COMMENTS

I. Status of Claims

Claims 1-20 were pending. Claims 1-12 have been withdrawn. Dependent claims 21-23 have been added.

II. Rejections of Independent Claim 13

Independent claim 13 requires an image sensor system that includes a bottom antireflection coating disposed between a color filter array and an active image sensing device structure.

A bottom antireflection coating is a well-known term of art that refers to a coating that is disposed between a patterning resist layer and underlying reflective structures to enhance control of critical dimensions in the patterning resist layer by suppressing reflective notching, standing wave effects, and the swing ratio caused by thin film interference. A bottom antireflection coating may suppress unwanted resist-activating radiation by absorption or wave cancellation, or both.

A. Rejection Under 35 U.S.C. § 102(b) Over Daly

The Examiner has rejected independent claim 13 under 35 U.S.C. § 102(b) over Daly (U.S. 5,654,202). In particular, the Examiner has asserted that Daly's planarization layer 18 corresponds to a bottom antireflection coating. Contrary to the Examiner's assertion, however, planarization layer 18 does not operate as a bottom antireflection coating. Moreover, based on Daly's teaching, one of ordinary skill in the art would not understand that planarization layer 18 could be a bottom antireflection coating.

According to Daly, planarization layer 18 is designed to provide a smooth, uniform surface over the active device area for a color filter array. To achieve this function, the "[s]pecific thickness of the coating is dictated by considerations relating to the height of the topographic features on the wafer" (col. 5, lines 30-32). Daly teaches that the planarization layer 18 may be a positive or negative photo-sensitive material. The bonding pads are exposed by patterning the photo-sensitive material directly by developing in a developer

solution or indirectly by etching regions exposed through an overlying, patterned photoresist layer. Regardless of its material composition, Daly teaches that planarization layer 18 must be stabilized so that it does "not swell and distort or absorb dye during the coating and dyeing steps which are an integral part of the CFA fabrication" (col. 7, lines 55-56). To this end, Daly teaches that:

> Typically, stabilization is effected by hardening or crosslinking the surface of the planarization layer by baking, with a crosslinking exposure by treatment with a plasma or with a combination of these treatments. In the case of negative imagable planarization layers which are crosslinked, baking alone may be adequate to form a tight stable network. Treatment with a non-oxygen plasma alters the chemistry of the surface while concurrently bathing the wafer in high intensity deep ultraviolet light. In each case, the process yields a planarizing layer which does not swell with solvent and which does not absorb dye. (Col. 7, lines 52-67)

Thus, before the color array is formed, the planarization layer 18 is processed into a stabilized, substantially inert layer with a thickness that is sufficiently high to cover and planarize non-planar features of the active device area. There is no hint in Daly that planarization layer 18 operates as a bottom antireflection coating that enhances control of critical dimensions in an overlying patterning resist layer by suppressing reflective notching, standing wave effects, and the swing ratio caused by thin film interference. Indeed, in accordance with Daly's teaching, planarization layer 18 must have a stable structure that is hardened and cross-linked. Thus, planarization layer 18 would not have sufficient absorptive properties to operate as a bottom antireflection coating during formation of the color filter array. In addition, there is no teaching in Daly that would suggest to one of ordinary skill in the art that the thickness of planarization layer 18 should be tailored to reduce back reflections during the formation of the color filter array.

In sum, Daly does not teach or suggest anything about bottom antireflection coatings; much less that planarization layer 18 could be a bottom antireflection coating. For at least these reasons, the Examiner's rejection of independent claim 13 under 35 U.S.C. § 102(b) over Daly should be withdrawn.

B. Rejection Under 35 U.S.C. § 102(e) Over Yang

The Examiner has rejected independent claim 13 under 35 U.S.C. § 102(e) over Yang (U.S. 6,184,055). In particular, the Examiner has asserted that Yang's passivation layer in FIG. 7J corresponds to a bottom antireflection coating (emphasis added):

> It is apparent in Yang et al.'s design that the passivation layer is an antireflection coating because in Col. 10 Lines 22 & 29-31 explains that metal layers M1 and M2 are used to shield non-photosensing regions and additional layers may be added to [do] that but it does not state that the passivation layer performs this task. It is apparent that the passivation layer allows light to transmit through, thus being an antireflection coating.

The fact that metal layers M1 and M2 might shield non-photosensing regions does not teach or suggest anything about the structure or composition of Yang's passivation layer. In addition, the fact that Yang's passivation layer is transparent to light within an operating wavelength range does not suggest that the passivation layer is an antireflection coating. The only teaching in Yang regarding the passivation layer is that the "passivation layer is formed for protecting the device from moisture and scratch" (col. 10, lines 23-24). Based on this limited teaching, one of ordinary skill in the at would understand that Yang's passivation layer is a conventional dielectric passivation layer, such as the silicon dioxide or silicon nitride passivation layer 17 in Daly's imager design.

In sum, there is no teaching whatsoever in Yang that would lead one of ordinary skill in the art to tailor the absorptive properties or the refractive properties, or both, of Yang's passivation layer so that it would suppress back reflections during the formation of the color filter array. For at least these reasons, the Examiner's rejection of independent claim 13 under 35 U.S.C. § 102(e) over Yang should be withdrawn.

III. Rejections of Dependent Claims

Dependent claims 14-23 incorporate the features of independent claim 13 and, therefore, these claims are patentable for at least the same reasons explained above. Dependent claims 14 and 16 are patentable for the following additional reasons.

For the purpose of the following discussion, the examiner is reminded that:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not on applicants' disclosure.

MPEP § 706.02(j). Furthermore, as pointed out by the Patent Office Board of Appeals and Interferences:

> The examiner should be aware that "deeming" does not discharge him from the burden of providing the requisite factual basis and establishing the requisite motivation to support a conclusion of obviousness.

Ex parte Stern, 13 USPQ2d 1379 (BPAI 1989).

A. Claim 14

The Examiner has rejected claim 14 under 35 U.S.C. § 103(a) over Daly in view of Dixit (U.S. 6,106,995).

With respect to the subject matter recited in dependent claim 14, the Examiner has indicated that:

> Referring to claim14, wherein the bottom antireflection coating comprises a dyed organic antireflection film-forming material, (Dixit et al. Col. 2, lines 9-11 and Col. 2, lines 15 & 16).
>
> It would have been obvious to combine the teachings of Daly et al. and the teachings of Dixit et al. because the dyed organic antireflection film reduces the reflectivity from the substrate allowing proper sensing from the sensor.

The sections of Dixit's Background section that are cited by the Examiner merely teach that dyed antireflection coatings are known. Dixit, however, does not teach or suggest anything that would lead one of ordinary skill in the art to replace Daly's planarization layer

18 with one of Dixit's antireflection films, as proposed by the Examiner. Indeed, in each of Dixit's exemplary embodiments, the thickness of the antireflection films ranged from about 56 nm to about 80 nm. Such thicknesses would not be sufficient to planarize topographic features of the device region in Daly's imager. Therefore, replacing Daly's planarization layer 18 with one of Dixit's antireflection films, as proposed by the Examiner, would defeat Daly's objective to provide a smooth, uniform surface over the active device area for a color filter array. A modification that would defeat the object of Daly's invention hardly would have been obvious to one of ordinary skill in the art. Accordingly, the Examiner's proposed combination of Daly and Dixit is impermissible.

For at least these reasons, the Examiner's rejection of dependent claim 14 under 35 U.S.C. § 103(a) over Daly in view of Dixit should be withdrawn.

B. Claim 16

The Examiner has rejected claim 16 under 35 U.S.C. § 103(a) over Daly in view of Murakami (U.S. 6,060,732).

With respect to the subject matter recited in dependent claim 16, the Examiner has indicated that:

> It would have been obvious to combine the teachings of Daly et al. and combine them with the teaching of Murakami because adjusting the thickness of an antireflective film would allow adjustment of the focal point and to the refractory angle, thus allowing the sensor to be adjusted and properly sense. These teachings are well known in the art and by people who wear [g]lasses.

Murakami teaches that an antireflection film 15 may be disposed over an active region of an image sensor to increase the sensitivity of the sensor by reducing reflections at the substrate surface that prevent incoming visible light from reaching the active region during operation of a completed CCD. In particular, Murakami teaches that:

> By setting the film thickness, an antireflection film having a relatively flat spectral characteristics (sic) in a visible light region can be obtained. Thus, by setting the film thickness of the seventh insulating film 12g and the antireflection film to an appropriate thickness, the reflection factor is suppressed to 12% to 13% at average. Since the incident light was reflected about

40% in the prior art P-type silicon substrate, the reflection factor can be reduced to about one third. (Col. 2, lines 7-14)

Murakami's CCD, however, does not include a color filter array. Accordingly, there is no teaching or suggestion in Murakami that would lead one of ordinary skill in the art to select the thickness of bottom antireflection coating to improve an optical transmission characteristic of one or more colors of a color filter array. To the contrary, Murakami only teaches that antireflection film 15 is designed to increase transmission of visible light to the active device region.

Daly does not teach or suggest anything about bottom antireflection coatings and Murakami fails to teach or suggest anything about selecting the thickness of an antireflection coating based on considerations of an optical transmission characteristic of one or more colors of a color filter array. Therefore, the combination of Daly and Murakami hardly could teach or suggest the inventive image sensor system recited in claim 16.

In addition, Murakami teaches that his antireflection film 15 should have a thickness on the order of 30-50 nm (see, e.g., col. 2, line 56). Such a thickness would not be sufficient to planarize topographic features of the device region in Daly's imager. Therefore, replacing Daly's planarization layer 18 with Murakami's antireflection film 15, as proposed by the Examiner, would defeat Daly's objective to provide a smooth, uniform surface over the active device area for a color filter array. A modification that would defeat the object of Daly's invention hardly would have been obvious to one of ordinary skill in the art. Accordingly, the Examiner's proposed combination of Daly and Murakami is impermissible.

For at least these reasons, the Examiner's rejection of dependent claim 16 under 35 U.S.C. § 103(a) over Daly in view of Murakami should be withdrawn.

IV. Conclusion

For the reasons explained above, all of the pending claims are now in condition for allowance and should be allowed.

Charge any excess fees or apply any credits to Deposit Account No. 50-1078.

Respectfully submitted,

Date: September 5, 2002

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